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sists. They average about three feet in width and in depth, and are frequently six hundred feet in length. Changes of level are ingeniously remedied by locks. The conception and execution of such enterprises presuppose a very high degree of foresight and intelligence.

The eighth chapter treats of the various modes of trapping the beaver, which are of course based upon an intimate knowledge of the animal's personal habits. In conclusion, we have a chapter on "Animal Psychology," in which many interesting facts and deductions are presented bearing on the metaphysics of the subject. Mr. Morgan advocates the claim of his beavers to "a thinking and reasoning and perhaps an immortal principle," with enthusiasm at least, if not with success. He is not disposed to be jealous of *ἀλογία ζῶα*, nor to think that it detracts at all from his own intellectual prerogatives as a talking being to concede to these intelligent mutes whatever "fragments of soul and tatters of understanding" they may furnish evidence of possessing. His volume contains some curious scraps of "beaver lore," of which the following may serve as a specimen. When the young beavers attain maturity, they are sent out from the lodge; if they fail to mate, they are allowed to return to the domicile, and remain till the ensuing summer; but, as a mark of parental disapprobation, they are put to hard labor in repairing the dam. They are then sent away again; if they fail a second time to mate, they are not permitted to return, but become thenceforth "out-cast beavers." The Indians and trappers firmly believe in the existence of such a class of Pariah beavers; and even Mr. Morgan seems to indorse the legend, when he suggests that they "are probably such beavers as, having lost their mates, refuse afterwards to pair. A similar story is the fiction of the slave beavers, related by Zacharia Ben Mahmoud Kazwiny, an Arabian naturalist of the thirteenth century.

The book is altogether one of the most valuable and interesting recent contributions to Natural History.

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10. — *The Voice in Singing.* Translated from the German of EMMA SEILER, by a Member of the American Philosophical Society. Philadelphia: J. B. Lippincott & Co. 1868. 16mo. pp. 168.

THIS little book is worthy of the most thorough criticism, which is already saying much for it. It is an attempt "to bring into harmony things which have always been treated separately,—the science and the art of singing": an attempt begun in the right spirit, cautious,

candid, prompted alike by love of beauty and of truth, and carried through in quiet earnest. And here is the simple story of results, in which much that is new is reported without egotism, and more anxiety is shown that the new knowledge may not be misused than to win credit for discovery. It is not a manual of singing, and does not profess to teach the art. It is a memoir embodying results of scientific observation while yet fresh, and pointing out their practical value; abounding, for the rest, in pregnant hints of what has been lost in the once noble art of song, and how it may be won back, and what good singing is. Beyond that, too, it has another charm, in that it is the record of a life's devotion, wherein all is set down so simply and so clearly, with such single wish that all may learn, as to give it unconsciously a beauty and a value as a literary production. The unpretending little book is really in its way a work of art, and, if only in that sense, was worthy to find a translator in the accomplished "Member of the American Philosophical Society" who has done so excellent a service in introducing it to the American reader.

Madame Seiler is a German lady, who to a musical character as such unites rare scientific attainments. After studying with the best masters, German and Italian, and singing with favor in concerts, she thought herself qualified to teach; but, more conscientious than most teachers, she was unwilling to proceed in the special culture of individual voices in the dark. Seeking light in schools, she found contradiction and confusion; doctors disagreed; each had a system of his own, with plentiful lack of reasons; no two used terms alike; in the jargon about registers, &c., all was bewilderingly vague, as every one who goes from method to method, from master to master, seeking to learn to sing, is pretty sure to find. Losing her voice at last (under an eminent teacher), she turned her attention to the piano, but without ceasing to pursue the knowledge of the human voice, as she indeed showed by choosing for her piano-teacher old Wieck, of Dresden, Clara Schumann's father, who is at the same time one of the wisest singing-masters of the day. There, too, she learned what she could by hearing Jenny Lind, in whom almost alone the great tradition lived. In Italy, the land of song, and in the schools of France, she also tarried, only to find "no sure and radical knowledge." Finally, the scientific instinct hinted of a surer way, and she sought the counsel of Professor Helmholtz, at Heidelberg, the great explorer of the natural laws of musical sound, from whom Tyndall draws so much which he has popularized in his delightful "Lectures upon Sound." Under his guidance she devoted herself to a long and patient observation, by means of the laryngoscope, of the physiological processes that go on in the larynx

in the production of musical tones. "My special thanks are due to him," she says, "that now, with a more thorough knowledge of the human voice, I can give instruction in singing, without the fear of doing any injury." In 1861 she published in Germany a part of her investigations, now incorporated with other matter in the work before us. Coming to this country with the fullest indorsement by Helmholtz, who speaks of having been assisted by her in his own "essay upon the formation of the vowel tones, and the registers of the female voice," she has taken up her abode in Philadelphia, where she has won the esteem of the most cultivated persons, and where her labors as a teacher of singing are already said to be bearing fruits worthy of her zeal in seeking a scientific basis on which to restore the natural method.

Opening with the common complaint, too well founded, that fine singers are becoming more and more rare, the book is full of regretful allusions to "that rich summer-time of song, not yet lying very far behind us, in the last half of the last century," when we read of such a multitude of noble voices, so full and sweet in tone, so wonderfully preserved, when measured by the short career of singers now-a-days. Catalani, Malibran, Rubini, Mara, were among the last of them. The first chapter is historical, tracing the rise, development, and decline of vocal music in a concise, clear, interesting manner, and showing how the very study of expression in the dramatic singer, the very æsthetics of his art, gradually tempted him into the neglect of its externals, of the sound culture of the vocal instrument, until it began to be thought only necessary to be *musical*, or at the most a singer, to be qualified for a teacher of singing. And so the tradition of true song was lost. True as the old Italian school was, it was yet *empirical*; it had found Nature's way by instinct, treasuring up lessons of experience; it "builded better than it knew"; its pupils "learned by imitation, as children learn their mother tongue." The tradition once lost cannot by empiricism be restored, nor by intuition, nor by any means short of a scientific verification of principles. Most men have drunk adulterated wines until their taste is no criterion of genuine flavors; so in the vocal art, "our feeling is no longer sufficiently simple and natural to distinguish the true without the help of scientific principles." It will not do to trust to Italian teachers just because they are Italian, and because (as Jenny Lind once said to us) the one only school of song is the Italian; for that, even in Italy, in these Verdi days, exists no longer. Broken-down Italian opera-singers, with pupils thronging to them in all countries, do the fashionable mischief. They have not known enough to save their own voices through a short summer's day, but they do know enough to spoil the voices of our children.

This by way of introduction. In the second chapter we come to the core of the matter, the "physiological view" of the voice, showing how sounds are formed in the larynx. The history of such investigations is first briefly sketched, beginning with the experiments of Müller, who succeeded in producing almost all the tones of the human voice from the excised larynx, and ending with Manuel Garcia's observations with the laryngoscope, he having been the first to apply this instrument to the larynx in the act of singing. Garcia's results are cited in full in his own words, and a brief anatomical description of the vocal organ, for the aid of the unscientific reader, is found in an Appendix. "The most eminent of singing-masters now living," Jenny Lind's master, did this of course purely in the interest of vocal music, watched the vibration of the vocal chords, and the concurrent play of the other portions of the larynx, with patient scientific accuracy, and his *Mémoire* was favorably reported on in the French Academy of Sciences. He did a great service, if only in establishing a truly scientific method of inquiry. But his results are, after all, incomplete and vague, especially in the cardinal point of determining the transitions of the registers, and though he names the *head tones*, he tells us nothing of them.

Madame Seiler's own use of the laryngoscope has been directed solely to the discovery of the natural limits of the different registers of the voice. Slowly and patiently getting such control of the epiglottis, or lid which covers the glottis, that she could at will lay bare to sight the whole length of the vocal chords, (Garcia tells us that one third of the glottis was always hidden from him by the epiglottis,) and learning to produce tones freely and naturally under such constraint, she is convinced that she has absolutely and precisely fixed the limits, not only of the three registers commonly, though vaguely, recognized, — the *chest*, the *falsestto*, and the *head*, — but also of an upper and a lower series of tones in the chest and in the falsestto register, thus making in reality *five* series of tones or registers, due to five different actions of the vocal organ, which are thus distinguished: —

"1. *The first series of tones of the chest register*, in which the whole glottis is moved by large, loose vibrations, and the arytenoid cartilages with the vocal ligaments are in action.

"2. *The second series of the chest register*, when the vocal ligaments alone act, and are likewise moved by large, loose vibrations.

"3. *The first series of the falsestto register*, where again the whole glottis, consisting of the arytenoid cartilages and vocal ligaments, is in action, — the very fine interior edges of the ligaments, however, being alone in vibrating motion.

"4. *The second series of the falsestto register*, the tones of which are generated by the vibrations of the edges alone of the vocal ligaments.

"5. *The head register*, in the same manner, and by the same vibrations, and with a partial closing of the vocal ligaments." — p. 65.

The falsetto register covers the same tones in the male and in the female voice, that is, the same octave in the general scale of tones. To the popular notion with which most of us grew up, this is at first bewildering. By *false* we were wont to understand that sort of feigned or false voice with which a man would try to sing like a woman. Now all the singing-masters, Madame Seiler with them, being too much engaged with *things* to cavil about names, borrow from the supposed *false* male tones a name for the same range of real tones in the female voice, where they are principal and normal. They are real, likewise, and legitimate in the male voice, only not characteristically masculine like the chest tones; whereas of the average female voice the *false* is the best part, the most womanly, most musical and beautiful. Our author marks the *transition* from the chest voice to the falsetto with a precision to which we have not been accustomed heretofore. It falls alike in *all* voices on the same tone, *fa*  $\sharp$ , while the other transitions differ by a note or two, because the male larynx is a third larger than the female. This is not important. On the other hand, it is not clear that she recognizes any head tones in the male voice.

Whether these results are final is more than a mere literary review may undertake to say; that question must be left to the more thorough criticism which we began with saying such a book deserves. It is for scientific experts, themselves familiar with the use of the laryngoscope, and with the art of singing, (and we have such among us,) to audit the account. But there is strong presumption in favor of Madame Seiler's statements: first, in the evident conscientiousness and carefulness of her investigations; then, in the fact that they have been repeated by men of science in Germany, and acknowledged as correct, and in the indorsement of men like Helmholtz and Du Bois-Reymond; then, in the practical wisdom which lights up every page, when it comes to the application of these principles to the culture of the voice; above all, in the irresistible persuasiveness of the whole spirit of the book, so sensitive to the demands of art as well as science, so fully alive to the spiritual as well as the physical conditions of good singing, so candid and impartial, and with such a zeal for truth, burning quietly and deeply, shining without rhetoric, blurred by no sentimentality. It is, at all events, a work of the right sort of *character* for such an undertaking.

But whether the soundness of the physiology be absolutely proved or not, there can be no doubt of the value of the application here made to the culture of the singing voice. The rules deduced are excellent. Thus, first of all, the registers may not be forced up beyond their lim-

its without "a straining of the organs which may be both seen and felt, and no organ will bear continual over-straining." This is the chief cause of the decay of voices. Tenors, emulous of some Duprez's *do di petto*, try to force the action of the chest tones up into the rightful domain of the falsetto; the registers become confused by habits wilfully begun, the natural limits are lost sight of, till the voice, continually weakened, is destroyed. Again, it is shown how the falsetto tones, without ceasing to be such, may be educated to a strength and fulness hardly to be distinguished from the chest tones. How much better this than "the forced-up chest tones of our tenorists, sung with swollen-out throats and blood-red faces"! Again, how we are misled by the terms *chest, throat, head* tones, — a distinction purely imaginary, a matter of the nerves; physical sensations being confounded with the seat of actual processes, which for *all* tones is in the throat, the larynx! And yet how rightly may the singer know which kind of tones he is producing by these same sensations! Passing a multitude of good directions about the training of the soprano and the other voices, (noting by the way that Madame Seiler, contrary to the common notion, finds mezzo-soprano and barytone voices by no means so common as the four chief kinds,) we only mention further the important advice, that *the male voice should be trained by men, and the female voice by women*: for this lady is not the slave of science to believe that singing can be learned by scientific explanations, when it must be done by imitation of examples, as the child learns to talk.

To the physiological succeeds the *physical* view, which tells us how to treat the instrument we have examined. This third portion of the work is full of sound suggestions. The laws and properties of tone are briefly recited, after Helmholtz and Tyndall, and particularly the *timbre* of tones, and its dependence upon what are called the *over-tones* (harmonics) which mingle with the fundamental tone, are dwelt on. Upon these natural laws are founded excellent instructions, chief among which are those relating to the control and the division of the breath; the importance of avoiding a *too great pressure of the breath*, lest "the form of the waves of sound most favorable to a good tone" be disturbed; the danger of the too common exhortation "to bring out the voice" as strongly as possible, in the first exercises, instead of beginning gently, gaining strength by slow and sure degrees; then the right direction of the vibrating columns of air, *bringing the voice forward in the mouth*; then the great matter of the vowels, and the adaptation of certain vowels to certain tones, so much neglected in the setting of words to music, and in which the old Italian vocal music offers the most classical and faultless model. And here the German

author, with all her enthusiastic feeling for the great song-composers of her country, shows her candor in confessing that these have not understood this matter,—nor another equally important: Schubert placing the words so that the favorable vowels seldom come upon the right tones; Schumann using intervals which come upon the boundary tones of the register; and Mendelssohn often laying the stress in his soprano songs upon the *fa* #, the transition from the falsetto to the head voice. What an importance this gives to the manner in which the words of a song are translated into another language! But we are anticipating. Flexibility of voice comes in for a good share of attention, and exercises to this end are recommended at an early stage,—florid passages, trills, other ornaments, arias before plain ballads: for the cultivation of flexibility is the “easiest and most grateful part of the education of the voice”; the large, sustained delivery of longer tones in simple melody, with all the light and shade and accent of expression, being indeed the last and crowning beauty of the singer’s art. Purity of tone, too, is a theme not lightly nor pedantically treated. But what avails it to skim over so many tempting topics which we can only name?

We have left ourselves no room to speak of the last chapter, in which the æsthetic view of the art of singing is presented very briefly, but with such sound common-sense and fine perception, and so beautifully and simply, that we would fain quote the whole. Of many good sayings take these specimens:—

“An artist must, therefore, be esteemed according as his works excite and ravish the hearers or beholders without their knowing why; and he stands all the higher, the simpler and the more naturally, i. e. the more *unconsciously*, this takes place.”

“Empty and dead as all technical knowledge is, unless it is animated with a soul, yet no product of art æsthetically beautiful is possible without a perfect technique.”

“Unhappily, our whole music is vitiated by this sickly sentimentalism, the perfect horror of every person of cultivated taste. In these later years the powerful reaction of German æsthetics has had favorable results in regard to instrumental music; but in the execution of vocal music this unhealthy fashion of singing still always commands great applause. This sickly sentimental style has also naturalized in singing a gross trick, unfortunately very prevalent, the *tremolo* of the notes. When, in rare cases, the greatest passion is to be expressed, to endeavor to deepen the expression by a trembling of the notes is all very well, and fully to be justified; but in songs and arias in which quiet and elevated sentiments are to be expressed, to tremble as if the whole



soul were in an uproar, and not at all in a condition for quiet singing, is unnatural and offensive."

Under this head the subjects of rhythm, correct understanding of the tempo, composition, the delivery of the sentiment of a work, and the aids to a fine execution are treated with good taste and judgment. And, finally, the time for beginning instruction is discussed, with strong recommendation of an early age, but with caution against the dangers to the young voice of singing in schools in chorus, where the teacher is satisfied, if the tones are only pure and the time is kept, but pays no regard to the formation of the tones.

The book is admirably translated, and on the whole we must regard it as the best essay upon the voice in singing that has yet appeared.

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11. — *The Musical Scale.* By HORACE P. BIDDLE. Boston : Oliver Ditson & Co. 1867. 12mo.

It is a curious illustration of the intellectual sympathy which turns the thoughts of widely separated men in the same direction, that, while Helmholtz, Tyndall, Lissajous, and other European students, were examining the phenomena of sound, and deducing from them its laws, Mr. Biddle, unaware for the most part of the labors of his fellow-workers, was pursuing similar investigations in Indiana.

A small edition of his book was printed in Cincinnati in 1860, the manuscript of it having been prepared in 1849. Mr. Biddle's researches, which have been carried on for thirty years, have led him to some opinions directly at variance on certain points with those now generally accepted by the more famous investigators of the subject.

Some of the points on which Mr. Biddle differs with Helmholtz and Tyndall may be briefly stated thus.

He considers the opinion that a musical tone is necessarily compounded of several tones to have no foundation. "It is impossible," he says, "for one tone to generate another." He does not believe that an harmonic is ever combined with a tone produced by a metallic tongue. He thinks it impossible that the vibrations of the whole chord and certain combinations of the harmonics should coexist; and explains the cases, if any such there be, where such harmonics are apparently produced, by his theory of resultant tones.

His hypothesis with regard to resultant tones is, that, each time the vibrations of two tones cross, they cause a vacuum; and that the air, rushing in to fill the vacuum, creates a third vibration.

He considers the theory that the musical scale should comply with the natural scale of harmonics fanciful and misleading.